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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* THEODORUS JOHANNES BROK,  
RUDOLF JOHANNES GROENEN, JEANINE MARIE KLINKENBIJL,  
and MARIETTE CATHARINA KNAAP

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Appeal 2009-003712  
Application 10/501,240  
Technology Center 1700

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Decided: August 11, 2009

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Before CATHERINE Q. TIMM, ROMULO H. DELMENDO, and  
JEFFREY B. ROBERTSON, *Administrative Patent Judges*.

DELMENDO, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from a final rejection of claims 1-4, 9, 12-16, 20, and 23 (Appeal Brief filed August 13, 2008, hereinafter “App. Br.,” at 2; Reply Brief filed October 13, 2008, hereinafter “Reply Br.”; Final Office Action mailed March 13, 2008). We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

### STATEMENT OF THE CASE

Appellants state that the claimed invention “relates to a process for removing carbon dioxide and optionally hydrogen sul[f]ide and/or COS [carbonyl sulfide] from a gas stream . . . by washing the gas with an aqueous washing solution containing water, sulfolane and a secondary or tertiary amine derived from ethanol amine [e.g., methyldiethanolamine (MDEA)]” (Specification, hereinafter “Spec.,” 1, ll. 1-8 and 1, l. 29 to 2, l. 3). According to Appellants, “the addition of a few wt% of piperazine [to an aqueous mixture of, e.g., MDEA and cyclo-tetramethylene-sulfone (sulfolane)] results in a clear improvement of the kinetics of the system, resulting in a lower liquid/gas ratio, which may result in a smaller design of the plant (absorber as well as regenerator)” (Spec. 2, ll. 10-13 and 23-27).

Claims 1 and 15, the only independent claims, read as follows:

1. A process for the removal of carbon dioxide from a gas stream containing carbon dioxide by washing the gas stream with an aqueous washing solution containing between 15 and 45 parts by weight water, between 15 and 40 parts by weight sulfolane and between 30 and 60 parts by weight of an amine selected from the group of amines consisting of MEA, DEA, TEA, DIPA and MDEA, wherein the parts by weights are based on the amounts of water, sulfolane and amine together being 100 parts by weight, and, further, wherein the aqueous

washing solution contains piperazine in an amount in the range of from 0.7 mol/l to 0.9 mol/l.

15. An absorbent liquid containing between 15 and 45 parts by weight water, between 15 and 40 parts by weight sulfolane and between 30 and 60 parts by weight of an amine selected from the group of amines consisting of MEA, DEA, TEA, DIPA and MDEA, wherein the parts by weights are based on the amounts of water, sulfolane and amine together being 100 parts by weight, and, further, wherein the aqueous washing solution contains piperazine in an amount in the range of from 0.7 mol/l to 0.9 mol/l.

(App. Br. 9 and 10, Claims App'x.)

The Examiner relied upon the following as evidence of unpatentability (Examiner's Answer mailed September 4, 2008, hereinafter "Ans.," 2-3):

Wagner      US 4,997,630      Mar. 5, 1991

Appellants rely on the following as evidence of nonobviousness (App. Br. 11, Evidence App'x):

Appl      US 4,336,233      June 22, 1982

The Examiner rejected claims 1-4, 9, 12-16, 20, and 23 under 35 U.S.C. § 102(b) as anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious over Wagner (Ans. 2-6).

## ISSUES

With respect to the anticipation rejection of claim 1, the Examiner asserts that Wagner "disclose[s] a process for the removal of CO<sub>2</sub> and/or H<sub>2</sub>S from gases by means of an aqueous methyldiethanolamine-containing absorption liquid [i.e., washing solution]" wherein the "aqueous absorption

liquid contain[s] from 20 to 70 preferably from 30 to 65, and in particular from 40 to 60 wt% of methyldiethanolamine [MDEA]" (Ans. 3). Furthermore, the Examiner finds that Wagner's washing solution can additionally contain sulfolane "in an amount of from 1 to 60, preferably from 10 to 50, [and] in particular from 20 to 40 wt%" and that "the balance of [the] aqueous washing liquid . . . would be water, which reads on the limitation as claimed" (*id.* at 4). With regard to piperazine, the Examiner finds that Wagner "disclose[s] advantageously, the aqueous methylenediethanolamine solution used additionally contains from 0.05 to 1, in particular from 0.1 to 0.8, and especially from 0.1 to 0.6 mol/l of . . . piperazine" (*id.*).

In the alternative, the Examiner asserts that "it would [have been] obvious to have piperazine to be 0.7 mol/l to 0.9 mol/l because [the] broad range of 0.05 to 1 mol/l [disclosed in the prior art] includes the narrow range of 0.7 mol/l to 0.9 mol/l" (*id.*).

Appellants, on the other hand, contend that the Examiner erred in finding anticipation because Wagner "does not teach *each and every element* of the unique washing solution recited in the present claims *with sufficient specificity*" (Reply Br. 4). In particular, Appellants assert that Wagner "does not teach [the] concentration range for water specified in the present claims, and in the sole specific example of an aqueous absorption solution, employs a water concentration outside of the range specified in the present claims" (*id.* at 3). According to Appellants, "Wagner . . . teaches three possible concentration ranges for MDEA . . . and three possible concentration ranges for a physical solvent . . . if a physical solvent is even used" (*id.*).

With respect to the Examiner's obviousness rejection, Appellants contend that "the prior art as a whole *teaches away* from the aqueous washing solution employed in the process recited in Appellant's [sic] claims" (*id.* at 4). Appellants assert that Appl, which is discussed in the Specification at page 3, teaches that "only very dilute aqueous solutions can be used together with piperazine, because of the formation of piperazine carbamate" (Reply Br. 4; App. Br. 7). Appellants contend that, despite Appl's teachings, they "have surprisingly found that such limitations do not occur when mixtures of water/sulfolane are used in certain proportions with piperazine and MDEA" (Reply Br. 4).

Thus, the issues arising from the contentions of the Examiner and Appellants are:

Have Appellants shown reversible error in the Examiner's finding that Wagner discloses the concentration ranges of components of a washing solution with sufficient specificity to support an anticipation rejection of the claimed subject matter?

If so, have Appellants shown reversible error in the Examiner's conclusion of obviousness as to claim 1 on the basis that Appl would have taught away from the claimed invention?

Have Appellants shown reversible error in the Examiner's obviousness rejection by showing persuasive evidence of unexpected results?

FINDINGS OF FACT (“FF”)

1. Wagner discloses a process for “removal of CO<sub>2</sub> and/or H<sub>2</sub>S from gases” using “an aqueous absorption liquid containing from 20 to 70, preferably from 30 to 65, and in particular from 40 to 60, % by weight of methyldiethanolamine [MDEA]” (col. 1, ll. 8-9; col. 2, ll. 30-32).
2. In an embodiment, Wagner discloses that “the aqueous methyldiethanolamine [MDEA] solution used additionally contains from 0.05 to 1, in particular from 0.1 to 0.8, and especially from 0.1 to 0.6, mole/l of . . . piperazine” (col. 2, ll. 36-43).
3. Wagner discloses that “[t]he aqueous absorption liquid containing from 20 to 70% by weight of methyldiethanolamine [MDEA] can additionally contain a physical solvent,” e.g., tetramethylene sulfone (i.e., sulfolane) “in an amount of from 1 to 60, preferably from 10 to 50, [and] in particular from 20 to 40, % by weight” (col. 2, ll. 44-54).
4. In a sole example, Wagner discloses an absorption liquid comprising “a 50% strength by weight aqueous methyldiethanolamine [MDEA] solution” (col. 6, ll. 56-59).
5. Appl discloses “that amongst the industrially used physical solvents, e.g. methanol, mixtures of cyclotetramethylenesulfone, DIPA and water (Sulfinol ®), NMP and dimethyl ethers of polyethylene glycols (Selexol ®), only very dilute aqueous solutions can be used together with

piperezine, because of the formation of piperezine carbamate”  
(col. 3, ll. 29-35).

### PRINCIPLES OF LAW

“Anticipation requires a showing that each limitation of a claim is found in a single reference, either expressly or inherently.” *Atofina v. Great Lakes Chemical Corp.*, 441 F.3d 991, 999 (Fed. Cir. 2006).

“In cases involving overlapping ranges, we and our predecessor court have consistently held that even a slight overlap in range establishes a *prima facie* case of obviousness.” *In re Peterson*, 315 F.3d 1325, 1329 (Fed. Cir. 2003).

“A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use.” *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994).

### ANALYSIS

#### *Anticipation of claims 1-4, 9, 12-16, 20, and 23*

Appellants have shown reversible error in the Examiner’s finding that Wagner anticipates the claimed invention. Table 1 below compares the concentration ranges of the components of the claimed washing solution with those of Wagner’s washing solution (FF 1-3):



Component	Claims 1 and 15	Wagner (broadest)	Wagner (preferred)	Wagner (most preferred)
MDEA wt%	30-60	20-70	30-65	40-60
sulfolane (wt%)	15-40	1-60	10-50	20-40
water (wt%)	15-45	balance	balance	balance
Piperazine (mol/l)	0.7-0.9	0.05-1.0	0.1-0.8	0.1-0.6

Table 1.

(Table 1 summarizes the ranges recited in claims 1 and 15 as well as the ranges disclosed in Wagner.)

As seen in Table 1, Wagner does disclose solutions comprising MDEA, sulfolane, and piperazine in concentration ranges that overlap the claimed ranges. But each of the four broadest disclosed ranges for MDEA, sulfolane, water, and piperazine includes concentrations that fall outside the ranges recited in claims 1 and 15. The same is true for Wagner's preferred ranges. In addition, although Wagner's "most preferred" ranges of MDEA and sulfolane are within the claimed ranges, at least the "most preferred" range of piperazine is completely outside the claimed range. Furthermore, Wagner does not disclose any working example describing specific concentrations within the claimed ranges (FF 4).

Thus, one of ordinary skill in the art would have had to resort to picking and choosing from among Wagner's disclosed ranges to arrive at a washing solution having components within the claimed ranges. Accordingly, Wagner does not describe the claimed range with sufficient specificity to anticipate. *See Atofina*, 441 F.3d at 999-1000.

*Obviousness of Claims 1-4, 9, 12-16, 20, and 23*

Appellants argue the appealed claims together. Accordingly, we select claim 1 as representative and confine our discussion to this selected claim. *See* 37 C.F.R. § 41.37(c)(1)(vii).

The Examiner's obviousness rejection stands on different footing. Regarding this rejection, we agree with the Examiner that the claimed subject matter would have been obvious to one of ordinary skill in the art over Wagner (Ans. 6; FF 1-3). As discussed above, Wagner's disclosed "broadest" and "preferred" ranges of MDEA, sulfolane, and piperazine overlap the claimed ranges. With respect to the range for water, Appellants have not shown error in the Examiner's finding that the prior art range for water overlaps the range recited in claim 1. Indeed, Appellants merely state that "the 'balance' of water would . . . vary widely, and at most would only partially overlap the specific concentration range for water recited in the present claims" (App. Br. 6). Under these circumstances, we discern no error in the Examiner's prima facie case of obviousness. *In re Peterson*, 315 F.3d at 1329.

We next consider whether Appellants have provided a showing of criticality or other evidence to rebut the Examiner's prima facie case. Appellants contend that Appl teaches away from the claimed washing solution because Appl states that "only very dilute aqueous solutions can be used together with piperazine, because of the formation of piperazine carbamate" (FF 5).

This contention lacks persuasive merit. First, claim 1 does not exclude carbamates. Second, Appellants have not directed us to any experimental evidence that they unexpectedly avoid the problem of

carbamates. Third, while Appl appears to disclose that “only very dilute aqueous solutions can be used” (FF 5), Wagner’s later-filed disclosure states that a washing solution comprising *non-dilute* aqueous solutions may be used (FF 1-3). Thus, Appellants have not shown any discovery beyond what would have been expected from the prior art. *In re Gurley*, 27 F.3d at 553.

### CONCLUSION

Appellants have shown reversible error in the Examiner’s finding that Wagner describes the claimed subject matter with sufficient specificity to support an anticipation rejection.

However, Appellants have not shown reversible error in the Examiner’s obviousness conclusion as to claim 1 on the basis that Appl would have taught away from the claimed invention.

Also, Appellants have not shown reversible error in the Examiner’s rejection of claim 1 with any persuasive evidence of unexpected results.

### DECISION

Accordingly, we reverse the Examiner’s decision to reject claims 1-4, 9, 12-16, 20, and 23 under 35 U.S.C. § 102(b) as anticipated by Wagner. We affirm, however, the Examiner’s decision to reject claims 1-4, 9, 12-16, 20, and 23 under 35 U.S.C. § 103(a) as unpatentable over Wagner.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(v).

### AFFIRMED

Appeal 2009-003712  
Application 10/501,240

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SHELL OIL COMPANY  
P. O. BOX 2463  
HOUSTON, TX 77252-2463